

**EFFECT OF EDIBLE BILAYER FILMS FROM SODIUM
CASEINATE AND FAT ON SURVIVAL OF
IMMOBILIZED *BIFIDOBACTERIUM*
IN TAPIOCA STARCH BEADS**

PANIDA RATTANAPITIKORN

A THESIS SUBMITTED TO THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN FOOD SCIENCE AND TECHNOLOGY

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright© by Chiang Mai University

All rights reserved

GRADUATE SCHOOL
CHIANG MAI UNIVERSITY
FEBRUARY 2005

**EFFECT OF EDIBLE BILAYER FILMS FROM SODIUM CASEINATE
AND FAT ON SURVIVAL OF IMMOBILIZED BIFIDOBACTERIUM
IN TAPIOCA STARCH BEADS**

PANIDA RATTANAPITIKORN

THIS THESIS HAS BEEN APPROVED
TO BE A PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY
IN FOOD SCIENCE AND TECHNOLOGY

EXAMINING COMMITTEE

Patcharin Raviyan CHAIRPERSON
Dr. Patcharin Raviyan

Leech Ozimek MEMBER
Prof. Dr. Lech Ozimek

Phuriwat Leesawat MEMBER
Asst. Prof. Phuriwat Leesawat

C. Kanongnuch MEMBER
Dr. Chatchai Kanongnuch

Nithiya Rattanapanon MEMBER
Prof. Dr. Nithiya Rattanapanon

Jakkapan Sirithunyalug MEMBER
Assoc. Prof. Dr. Jakkapan Sirithunyalug

Wiwat Wangcharoen MEMBER
Asst. Prof. Dr. Wiwat Wangcharoen

24 February 2005

© Copyright by Chiang Mai University

ACKNOWLEDGEMENT

I wish to express my sincere gratitude and respect to Prof. Dr. Lech Ozimek, Dr. Patcharin Raviyan, and Asst. Prof. Dr. Phuriwat Leesawat, for their ideas, and advice throughout my Ph.D.'s program. I am thankful for their willingness to take the time to make suggestions and help me achieve my goals. Their support, guidance, and encouragement were most appreciated.

Thanks are also expressed to Prof. Dr. Gerald Tannoc, Prof. Dr. Nithiya Rattanapanone and Dr. Takuo Nakano who never hesitate to help me when I asked for a favor; the members of my advisory committee, Dr. Chartchai Khanongnuch who introduced me to bifidobacteria and the member of my examining committee, Assoc. Prof. Dr. Jakkapan Sirithunyalug and Asst. Prof. Dr. Wiwat Wangcharoen who gave me their valuable time to evaluate my work and gave some suggestions. I also thank Miss Laura Smith, all of the graduate students, technical staffs and lab's supervisor at Department of Agricultural, Food and Nutritional Science, University of Alberta, Canada, that assisted in this research. In particular, I am grateful to the Royal Thai Government for their financial support during my graduate study.

Finally, I would especially like to thank my parent, my brother and my sister in law for their love, support, and encouragement that they have given me throughout my academic career.

Panida Rattanapitikorn